POWER COST STUDY:

MINNESOTA 37 JACKSON

UNITED STATES DEPARTMENT OF AGRICULTURE
RURAL ELECTRIFICATION ADMINISTRATION,
WASHINGTON, D. C.

POWER DIVISION

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Approved by:_____
Ivan A. Bosman, Head
Internal Combustion and
Hydro Plants Section

_____
Karl B. Crawford, Acting Head
Power Operations Section

_____
Thomas B. Dunphy, Acting Head
Power Procurement Section

FWBennett

SYSTEM POWER ANALYSIS

MINNESOTA 37 JACKSON

The Federated Rural Electric Association (Minnesota 37 Jackson) now purchases approximately 40 percent of its requirements from the Municipal Power Plant at Fairmont, Minnesota and generates the remainder in its own dual-fuel diesel plant at Jackson, Minnesota.

Funds in the amount of $290,000 will be required by the cooperative so that it may install a fourth 1230 kw dual-fuel diesel generating unit in its generating plant at Jackson. As shown by this study, the installation of this fourth unit will be the most practical and economical method for providing the cooperative with enough capacity to serve its allocated load adequately.

When the system's allocated load of 26,474,025 kwh has been reached, it is estimated that the average cost of power will be 1.18 cents per kwh. This includes both the cost of generation at Jackson and the required expenses for purchased power from the City of Fairmont but does not include expenses on the cooperative's 34.5 kv transmission system.

On the same basis, it is estimated that the average cost of power when the estimated 1960 load of 47,000,000 kwh has been reached will be 1.11 cents per kwh.

J. K. Taylor, Head
Power Planning Staff
Power Division

FWBennett

POWER COST STUDY

MINNESOTA 37 JACKSON

INTRODUCTION

The Federated Rural Electric Association (Minnesota 37 Jackson) now supplies its energy requirements by purchasing approximately 40 percent of its requirements from the Municipal Power Plant at Fairmont, Minnesota and by generating the remainder in its own dual-fuel diesel generating plant at Jackson, Minnesota. This generating plant has been in operation for only a few months but the load on the plant has already approached the firm plant capacity. Estimated load growth indicates that additional capacity will be required by the cooperative if it is to serve its estimated loads adequately.

This Power Cost Study determines the manner in which this additional capacity should be added to the system.

CONCLUSIONS

Funds in the amount of $290,000 will be required by the cooperative in order that it may install a fourth 1230 kw dual-fuel diesel generating unit in its generating plant at Jackson. The installation of this additional generating capacity together with the existing facilities at the Jackson plant will provide the cooperative with firm power to supply its allocated loads.

When the cooperative's allocated load of 26,474,025 kwh has been reached, it is estimated that the average cost per kwh will be 1.18 cents. This cost includes both the cost of generation at Jackson and the required expenses for purchased power from the City of Fairmont but does not take into account expenses on the cooperative's 34.5 kv transmission system.

On the same basis it is estimated that the average cost of power when the estimated 1960 load of 47,000,000 kwh has been reached will be 1.11 cents per kwh.

The installation of this 1230 kw dual-fuel diesel generating unit by the cooperative will be the most practical and economical method for the cooperative to solve its power supply problem.

PRESENT SYSTEM

At present the cooperative's energy requirements are obtained from the following two separate sources:

(1) The Municipal Power Plant at Fairmont, Minnesota now sells to the cooperative approximately 40 percent of its energy requirements. A ten-year contract exists between the City of Fairmont and the cooperative which allows the cooperative

to purchase up to 3000 kw. On the basis of this contract the City installed an additional 4000 kw generating unit to help supply its own needs and the future requirements of the cooperative.

(2) The remainder of the cooperative's energy requirements is supplied by the cooperative's generating plant at Jackson, Minnesota. This generating plant has been in operation for several months and is composed of 3-1230 kw dual-fuel diesel generating units. Power is produced at 4160 volts and stepped up to 34.5 kv at the plant substation and then transmitted to the various distribution substations located in the area.

These present sources of power are providing reliable and economical electrical service to the cooperative and are ideally located for that purpose. There is no connection as yet between these two sources of supply although money has been loaned for this purpose and therefore the cooperative operates as two separate and distinct systems. Service from the Fairmont Municipal Plant, which in view of its recent plant expansion has sufficient firm capacity for the cooperative's requirements, is supplied to the eastern portion of the system. The cooperative's plant at Jackson is serving the western portion of the system where an unprecedented increase in demand has been recorded. In order to meet the evening peaks in the area the third unit in the generating plant has to run over the evening peaks.

In view of this fact it is considered essential to provide the cooperative with an additional unit in order that firm power may be had to supply the cooperative's demand in the area.

NEW CONSTRUCTION

The scope of the proposed construction is as follows:

1. The installation of a fourth 1230 kw dual-fuel diesel generating unit with all the necessary auxiliaries in the Jackson plant.

2. An additional bay for the plant substation and a 34.5 kv oil circuit breaker will be required although no new transformer capacity is necessary. It will not be necessary to purchase a transformer for stepping up the generating voltage to 34.5 kv as the cooperative installed a spare unit at the time of the original plant installation. Since this is a unit type plant this spare transformer can be used with the fourth generating unit.

Inasmuch as the existing building was designed for the installation of four units, alterations to the existing building made necessary by the proposed addition of the fourth unit will be kept to a minimum.

WHOLESALE POWER CONTRACT

The cooperative and the City of Fairmont have in effect a 10-year power contract which will expire October 2, 1957 which permits the cooperative to purchase up to 3000 kw. The rate schedule under which the cooperative may be billed for power and energy under this contract is as follows:

Demand	1st - 1000 kw	@	$1.25/kw/mo.
	Excess	@	.90/kw/mo.
Energy	1st - 200 hrs. use per month	@	0.9¢/kwh
	Excess	@	0.7¢/kwh
plus a fuel adjustment now averaging			1.1 mills per kwh

The cost of power from the City of Fairmont has been computed in Appendix III using the above rate schedule.

GAS RATE SCHEDULE

Gas is supplied to the cooperative by the People's Natural Gas Company and the contract on file with REA contains the following rate schedule:

First	600 C.F.	$1.00
Next	1,400 C.F.	0.80 per M.C.F.
Next	3,000 C.F.	0.70 per M.C.F.
Next	45,000 C.F.	0.50 per M.C.F.
Next	50,000 C.F.	0.40 per M.C.F.
Next	200,000 C.F.	0.30 per M.C.F.
Excess Over	300,000 C.F.	0.20 per M.C.F.

In the engineering report submitted by Pfeifer and Shultz in December 1950 the following rate schedule for gas was given.

First	500 C.F.	$1.00
Next	1,500 C.F.	1.00 per M.C.F.
Next	3,000 C.F.	0.80 per M.C.F.
Next	45,000 C.F.	0.50 per M.C.F.
Next	50,000 C.F.	0.40 per M.C.F.
Next	200,000 C.F.	0.30 per M.C.F.
Excess Over	300,000 C.F.	0.23 per M.C.F.

Since the rate schedule on file at REA is two years old and contains a clause saying that all increases in cost of gas to the Peoples Natural Gas Company will be passed on to the consumer it is very possible the higher rate schedule submitted by the engineer is now in effect. Therefore in all cost computations involving natural gas this higher rate schedule was used.

Since the gas is purchased on an interruptible basis it can be expected that the People's Natural Gas Company may curtail service during severe weather. For this reason an availability of gas of 83-1/3 percent has been assumed. Pfeifer and Shultz have investigated the gas situation and call this a conservative estimate.

ALTERNATIVE PLAN

Consideration was given by the cooperative's engineer to the 34.5 kv transmission line between Fairmont and Jackson as a means of supplying the necessary additional power to the Jackson plant. This energy would have to be purchased from the City of Fairmont.

The conclusions reached by the engineer in regard to this transmission line are as follows: "The use of the transmission line was not considered feasible for supplying firm power to the cooperative's plant, due to the line loss which would increase the cost of delivered power at the plant site above the cost of generation by the cooperative, and the necessity of increasing the capacity of the recently installed substation at Fairmont. Other considerations include the fact that it is neither desirable to approach the firm power available at Fairmont nor exceed the 3000 kw demand limit stated in the contract."

In order to verify the decision of the engineer the following computation comparing the cost of purchased and generated energy were made.

KWH Generated	3,600,000
Approx. 1/4 of allocated requirements	
Fuel & Lube cost per kwh generated	4.85 mills per kwh
Total Fuel & Lube cost	$17,500
Increased Labor & Maintenance Material Expenses	4,200
Interest & Amortization $290,000 @ 4.1%	11,900
	$33,600
Cost per kwh	9.3 mills per kwh

Purchased power, even if bought at a high load factor would not average less than 10.0 mills per kwh under the present rate schedule.

On the basis of the above analysis it is shown that the fourth unit should be installed at this time rather than purchasing the additional power through a transmission interconnection between the municipal plant at Fairmont and the cooperative's plant at Jackson if the cooperative is to keep its cost of power to a minimum.

Originally it was thought that a stand-by agreement could be worked between the cooperative and the City of Jackson. Under this arrangement the City and the cooperative would supply power to each other under emergency conditions and the installation of the fourth unit could be postponed. However, efforts to obtain such an agreement have been unsuccessful; so the cooperative, in order to insure firm capacity for its system, will have to install a fourth 1230 kw diesel unit.

COST OF POWER

The table below shows the various expenses incurred by the cooperative for the various load conditions analyzed in this study.

System Expenses	1952	1955	1960	Allocated
Generation	$150,500	$232,500	$372,000	$166,000
Purchased Power	122,840	135,230	150,620	146,160
Total	$273,340	$367,730	$522,620	$312,160
KWH @ SS	20,000,000	28,400,000	47,000,000	26,474,025
Cost per KWH @ SS (¢/kwh)	1.36	1.29	1.11	1.18

LOAD DATA

A memorandum from A. W. Gerth, Chief, Applications and Loans Division to J. B. McCurley, Chief, Power Division, dated January 12, 1951 approves the use of the loads contained in the engineering report prepared by Pfeifer and Shultz on the subject cooperative as the basis for the 1952, 1955, and 1960 loads used in this study. This memorandum gives 26,474,025 kwh as the allocated load to be used in conjunction with this proposed loan.

This load data is summarized in Appendix I.

APPENDIX I

LOAD DATA

Total at Substations

	1952	1955	1960	Allocated
KW	5,600	7,200	10,200	6,000
KWH	20,000,000	28,400,000	47,000,000	26,474,025
L.F.	41	46	53	50

Total At Sources (4% Transmission Losses)

KW	5,840	7,500	10,620	6,250
KWH	20,800,000	29,600,000	49,000,000	27,600,000

Purchased

KW	2,920*	3,000*	3,000*	3,000*
KWH	10,400,000	11,850,000	13,850,000	13,250,000

Generated -- Net

KW	2,920	4,500	7,620	3,250
KWH	10,400,000	17,750,000	35,150,000	14,350,000

Generated - Gross (5% Station Use)

KW	3,070	4,740	8,020	3,420
KWH	10,950,000	18,700,000	37,000,000	15,100,000

*Assume average monthly demand to be 90% of maximum annual demand.

APPENDIX II

	1952	1955	1960	Allocated
KW - Purchased	2,920	3,000	3,000	3,000
Generating Capacity - KW	3,690	3,690	3,690	3,690
Capacity this request - KW	1,230	1,230	1,230	1,230
Capacity Future - KW	-	2,000	6,000	-
Capacity System Firm - KW	6,690	7,920	11,920	6,690

INVESTMENTS

INVESTMENTS -- THIS REQUEST

1-1230 kw dual fuel generating unit auxiliaries and installation	$190,000
Foundations and structures	14,000
Electrical equipment - wiring and installation	30,000
Engineering & Legal	15,000
Overhead and Contingency	11,000
Miscellaneous Construction (Radiator enclosure)	10,000
Total	$270,000
Substation Addition	
Structure, labor and material	17,000
Engineering	1,000
Contingency	2,000
Total	$20,000
Grand Total	$290,000

INVESTMENT RECAPITULATION

	1952	1955	1960	Allocated
Generation (incl. step-up sub.)				
Previous Loans	$812,000*	$812,000	$812,000	$812,000
This Loan	290,000**	290,000	290,000	290,000
Future	-	425,000[1]	1,285,000[2]	-
Total	$1,102,000	$1,527,000	$2,387,000	$1,102,000

*3 - 1100
**1 - 1100 plus substation improvements

(1) 1 - 2000kw units plus substation capacity

(2) 3 - 2000 kw units plus substation capacity

APPENDIX III

ANNUAL COSTS

	1952	1955	1960	Allocated
Purchased Power				
First 1000 kw @ $1.25/kw/mo.	$15,000	$15,000	$15,000	$15,000
X @ 90¢/kw/month	17,600	18,350	18,350	18,350
First 200 hrs. use per mo. @ 0.9¢/kwh	56,600	58,400	58,400	58,400
X @ 0.7¢/kwh	28,700	37,600	51,600	47,500
Fuel adjustment (0.11¢/kwh)	11,400	13,000	15,200	14,600
Gross Bill	$129,300	$142,350	$158,550	$153,850
Discount	6,460	7,120	7,930	7,690
Net Bill	$122,840	$135,230	$150,620	$146,160
Cost/kwh purchased (¢/kwh)	1.18	1.14	1.09	1.10
KWH Net Generated	10,400,000	17,750,000	35,150,000	14,350,000
KWH Gross Generated	10,950,000	18,700,000	37,000,000	15,100,000
Generation				
Fuel - Diesel Oil	$15,600	$26,600	$52,700	$21,500
Natural Gas	22,500	38,000	75,500	30,500
Pilot Oil	7,540	12,800	25,400	10,350
Lube - 1500 kwh/gal @ 65¢	4,750	8,100	16,050	6,550
Payroll	25,000	35,000	45,000	25,000
Main. Mat. & Supplies	8,000	15,000	18,000	12,000
Other Oper. Exp. & Supplies	1,000	1,500	1,500	1,000
Taxes & Insurance	10,000	18,000	20,000	10,000
Interest & Amortization	-	-	-	45,300
Interest & Depreciation	55,200	76,300	116,600	-
Replacement	-	-	-	3,000
Miscellaneous	910	1,200	1,250	800
Total	$150,500	$232,500	$372,000	$166,000
Cost/kwh net Gen. (¢/kwh)	1.45	1.31	1.06	1.15

(1) Straight fuel oil operation (11.7¢/gal) 13.7 kwh/gal)
Dual-Fuel Operation - Oil (1000 BTU/KWH) (142,000 BTU/Gal)
Gas (10,500 BTU/KWH) (1,000 BTU/C.F.)
83-1/3% - Dual Fuel Operation - 16-2/3% Fuel oil operation

Summary of Annual Expenses

Purchased Power	$122,840	$135,230	$150,620	$146,160
Generation	150,500	232,500	372,000	166,000
Total	$273,340	$367,730	$522,620	$312,166
KWH @ SS	20,000,000	28,400,000	47,000,000	26,474,025
Cost per kwh (¢/kwh)	1.36	1.29	1.11	1.18